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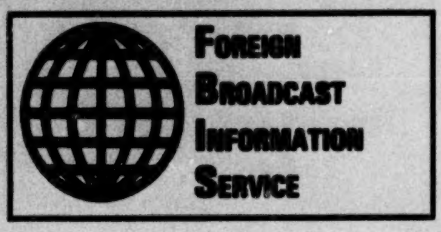

JPRS Report

Science & Technology

Europe

EC Commission Proposal for Space Program

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CONTENTS

36980097 Brussels COMMISSION OF THE EUROPEAN COMMUNITIES COM (88) 417 in English 26 Jul 88

[Communication from the Commission: "The Community and Space: A Coherent Approach"]

EC Commission Proposes Space Program

Introduction

36980097 Brussels COMMISSION OF THE EUROPEAN COMMUNITIES COM (88) 417 in English 26 Jul 88 pp 1-3

[Communication from the Commission: "The Community and Space: A Coherent Approach"]

[Excerpts] 1. Space is an area in which the Community now seems destined to play a broader and more active role for a combination of reasons:

— The era of the conquest of space has given way to an era of space exploitation. Against a background of growing involvement leading to more opportunities for cooperation but also increased competition, a whole series of already well established applications (telecommunications, Earth observation) or emerging applications (microgravity) have given rise to new challenges. Today space is far more than just a specific sector of activity; it will affect more and more the whole economic, industrial and cultural life of European society.

— Relying on the expertise developed especially as a result of the cooperation within the framework of the European Space Agency (ESA), Europe has now reached the stage of commercial exploitation in a number of sectors such as launch vehicles or telecommunications. In fact, through the decisions taken at The Hague in December 1987, it has continued the existing momentum by embarking on an ambitious space program geared to the year 2000, structured around the Ariane V. Hermes and Columbus programs.

— With the adoption of the Single Act the Community has recently acquired wide-ranging and explicit competences in the field of research and technological development. Above all, it is already mobilizing for the completion of the large internal market by 1992, a process which has implications for many sectors concerned by space activities and which cannot be divorced from Europe's pursuit of its ambitions in space.

2. When it comes to realizing its ambitions Europe has a large number of strong points to its credit, as demonstrated by the string of successes with Ariane, Spacelab, Giotto, etc. However, alongside the strengths to which these successes testify, Europe's space effort also suffers from a number of weaknesses. While a great deal of effort has been put into the development of space systems, there is still a need for a matching effort to encourage exploitation of the potential offered by these techniques. Europe is still without a cogent overall policy which incorporates technological, industrial, commercial, social, and even defence aspects.

3. Taking into account these weaknesses on the one hand and the institutional nature of the Community on the other, it would appear that Community action in space is both possible and desirable and that such action would indeed make a significant contribution to Europe's space effort, provided that the Community endeavours

— to put the full weight of its democratic legitimacy and its established role in European society behind the ambitious new programs which the ESA has decided to undertake and to further enhance, by strengthening its links with the ESA, the political credibility of Europe's space effort on the international stage;

— to frame policies that create favourable conditions for the development of the technologies needed for access to space and for optimum exploitation of space applications, on the one hand, and for the integration of these applications in the socio-economic fabric of the Community and for the strengthening of the European space industry's presence in the world, on the other;

— to ensure, through organic consultation mechanisms, that action by the Member States, the ESA and other European organizations (Eutelsat, Eumetsat, and so on) in the space sector remains consistent with Community law on competition, trade policy, opening up of public procurement, intellectual property, etc.

4. The Commission is proposing for the purposes of future Community action in space, six action lines intended to provide a coherent framework for the development of its activities. These action lines are as follows:

(1) **Research and technological development (R&TD):** to promote greater complementarity and synergy between Community R&TD strategy and the programs of the space agencies. In particular, this will entail improving coordination between the relevant Community programs, (Esprit [European Strategic Programs for Research and Development in Information Technology], Brite [Basic Research in Industrial Technologies for Europe], Euram [European Research on Advanced Materials], RACE [Research and Development in Advanced Communications Technologies for Europe], a number of JRC [Joint Research Center] programs, etc.) and European space programs; to define and give effect to Europe's contribution to the international study program on "global change" on our planet; to stimulate under the existing programs projects involving microgravity experiments and to promote the development of applications (telecommunications and Earth observation).

(2) **Telecommunications:** to develop a coherent approach by ensuring that satellite technology is included in the development of European networks and services and by optimizing the complementary relationship of satellite and terrestrial systems; to create the

political, regulatory and standardization conditions conducive to the development of new services and equipment; to promote the use of satellite communication systems in the implementation of Community policies on regional development, development aid, education, transport etc.;

(3) **Earth observation:** to stimulate the applications market particularly by extending and intensifying the integration of satellite information in the implementation of Community policies (agriculture, environment, regional development, development aid, etc.); by promoting cooperation and coordination in R&TD with regard to techniques for processing and interpreting satellite data.

(4) **Industrial development:** to study in greater depth in conjunction with the relevant bodies concerned the implications of the single market with regard to space activities and space-related activities.

(5) **Legal environment:** to contribute to the creation of favourable conditions for the development of European space activities by studying and proposing appropriate measures in the field of commercial and competition policy, tax and customs arrangements and harmonization of legislation.

(6) **Training:** to encourage under the Comett program the development of European advanced training schemes related to space science and technology and their applications.

Six Development Areas Proposed

36980097 Brussels COMMISSION OF THE EUROPEAN COMMUNITIES COM (88) 417 in English 26 Jul 88 pp 27-35

[Excerpts] In the light of its analyses which will be pursued and consultations with the European Space Agency and other relevant organizations and parties, the Commission considers that Community action could contribute in a significant way to removing a number of obstacles to the optimal exploitation of Europe's space potential. It is therefore proposing six action lines for the consistent development of its space activities.

A. Research and Technological Development (R&TD): Promoting Greater Complementarity and Interaction Between the Community R&TD Strategy and the Programs of the Space Agencies

Three sectors should be distinguished:

1. Space: a technological frontier

Implementation of the new ESA programs (Ariane V. Hermes and Columbus in particular) will call for the acquisition of new knowledge and technological expertise in a number of generic fields also relevant to other industrial sectors: information and communications technologies, robotics, advanced materials, aerodynamics, aerothermodynamics, man-machine interface, reliability and safety of complex systems, quality control, energy sources, medical sciences and technologies, etc.

A comparative analysis of the technological requirements of the ESA programs and the objectives of the Community's research program shows many points of convergence. A large number of Community programs are concerned: Esprit, Brite, Euram, RACE, medical and health research, radiation protection, non-nuclear energy, several JRC programs and new programs in the aeronautical sector and on robotics in hostile environments (Teleman).

Regular exchanges of information and coordination with the ESA are therefore indispensable both at the planning level and in the implementation of research programs so as to avoid duplication and facilitate use by the space industry of the technologies developed under Community programs.

The space programs also generate new knowledge and technologies that could be used by non-space industries.

The space agencies' efforts to exploit technological opportunities could benefit from the experience and support from the Community activities to promote technology transfer and innovation.

2. Space technologies and facilities: tools at the service of research

2.1 Study of our planet: climate, environment and global change

Earth observation satellites are a major source of information for the development of climate models and the study of the impact of human activities on climate and environment.

The development of new remote sensing techniques and the gradual establishment of a world space observation network make it possible to plan for the systematic study of the planet and its global change (in particular greenhouse effect and depletion of the ozone layer) leading to the acquisition of knowledge vital to the more efficient management of our environment and of human activities.

Since this is a problem that has international implications and raises major issues for society, Europe must organize itself so as to play an active and consistent role in international programs relevant to these areas. It must rapidly define its objectives and priorities and set up the necessary mechanisms and resources enabling it to participate on a more even footing with the United States and the USSR.

Considering that Community action would be the most efficient way of stimulating and coordinating efforts at European level, the Commission intends to submit, for the next review of the framework program on research and technological development, a proposal for action which follows up the programs now under way or in preparation. It will also see to it, in cooperation with the ESA, that there is a proper balance between space missions and the requirements of the scientific community.

2.2 Microgravity: encouraging preparations for the use of the orbital infrastructure

Like the United States and Japan, Europe is spending large amounts, mainly within the ESA, on setting up an orbital infrastructure which will greatly increase the opportunities for microgravity experiments. The ESA activities are focused essentially on the financing of platforms, mission costs and multi-user equipment; a major additional effort is therefore needed to prepare for the use of this experimental potential.

Under existing research programs the Commission intends to encourage a few collaborative projects that will bring together various user groups on particularly promising subjects. At the same time it will continue its consultations with the ESA and other parties concerned in order to determine more precisely the priority objectives and procedures for a possible Community program, on a wider and more ambitious scale, that would complement the activities of the ESA and the Member States.

3. Research and development to promote applications of space systems

This point is dealt with under action lines B. Telecommunications and C. Earth observation.

B. Space and Terrestrial Telecommunications: Need for a Consistent Approach to the Network, to the Development of New Services and to Regulations

In line with the Community's overall telecommunications policy, which regards the strengthening of European telecommunications as one of the essential conditions for a competitive market in the Community, the Commission put forward in June 1987 its Green Paper on the future development and liberalization of telecommunications. One of the reasons for this document is the need to reach common positions on the modification of the regulatory environment for telecommunication satellites in Europe; its objective is in particular the complete and gradual opening of the terminal market to competition and the definition of common European positions within various international bodies.

The Commission intends to pursue these aims as regards telecommunications satellites by developing the following activities:

1. Ensuring that satellite techniques are taken into consideration in the development of networks and services at European level and optimizing the complementarity of satellite and terrestrial systems

Coordination will be necessary between the Commission, the telecommunications administrations, satellite operators and the ESA. Ongoing technological progress towards more powerful satellites and hence less costly ground terminal equipment is a trend that is likely to continue, at least for some time, and could lead to an in-orbit switching capability. To make full use of the advantages of this technological development, careful planning of the overall network will be necessary so as to ensure continuous complementarity and compatibility between terrestrial techniques and the new generations of satellites.

2. Creating the political, regulatory and standardization conditions necessary for the development of new services and equipment to ensure maximum exploitation of space systems

Here the Commission proposes to act at three levels: harmonization of standards for communication systems (satellite access) and ground equipment, promotion of the study of regulatory systems likely to provide favourable conditions for the development of value added services and political action to ensure the setting up of a European telecommunications network with optimum complementarity of the various telecommunications techniques (see details in Annex 1).

3. Promoting the use of satellite communication systems in the implementation of Community policies

The Commission will continue and step up its efforts to achieve the following objectives:

- *Rural and regional development:* improvement of the advanced telecommunications infrastructure in the less-favoured regions of the Community (STAR) and in the Mediterranean basin.
- *Aid to developing countries:* helping to finance studies, technical assistance and the space communications infrastructure.
- *Education and training:* promotion of the use of new technologies to improve levels of skills in the Community.
- *Transport:* improvement of land and sea communications, especially for small firms, and study of the potential of space techniques for surveillance and management systems for land, air and sea traffic.
- *Fishing:* analysis of the various satellite options for communications and the positioning of fishing boats.

4. R&D to promote the development of space system applications

Through its R&D activities the Commission will help to promote the development of applications of satellite systems, whether under the RACE program (development of technologies for a pan-European integrated broadband telecommunications network), the new Delta program (distance learning applications) or specific projects concerning the adaptation of ground equipment to the Third World market.

C. Earth Observation: Stimulation of the Applications Market

The use of space data will become an important, if not indispensable, aid in the implementation of several Community policies: agriculture, environment, fisheries, regional development and development aid. The use of these data in scientific research (studies of our planet in particular) is covered in section A.2.

The Commission intends to extend and intensify the integration of satellite information in the implementation of Community policies.

Because of the extent, continuity and variety of the Community's demand, both as a final user and as an intermediary for final users such as regional or local authorities and developing countries, the Community is bound to have a decisive effect on the establishment of a stable applications market.

Consequently the Commission proposes a coordinated set of actions designed not only to develop operational applications meeting its own requirements but also to stimulate the development of applications markets in general.

1. Promoting European cooperation and coordination in R&D on methods and techniques for processing and interpreting satellite data

The Community is already active in this field with the JRC's remote sensing program which is already helping to improve the consistency of national efforts. However, they are still too scattered. The gradual broadening and expansion of Community activities is necessary not only for the requirements of its own policies but also, through a network of laboratories associated with the JRC's work and by shared-cost projects, to stimulate European cooperation amongst all those concerned, whether laboratories or industry. In the context of that cooperation the Commission will also endeavour to promote product standardization.

2. Stepping up the demonstration of operational applications (pilot projects), promoting feasibility studies and implementing operations systems in Europe

This mainly, although not exclusively, concerns applications relevant to the Community's sectoral policies mentioned earlier. An initial analysis of the applications of space data in Community policies is given in Annex 2.

3. Familiarization, training and assistance for users

A Community action plan for training in remote sensing techniques based on existing programs (the JRC's Ispra courses, Erasmus, Comett and Science) appears useful and should be carried out in cooperation with national activities. The JRC will also endeavour to exploit better its experience by being more active in the areas of receiving research scientists and giving assistance in the implementation of projects. This would apply in particular to European countries not having the necessary infrastructure and to the developing countries. For the latter, coordinated projects involving financial and technical support for local training should also be developed.

4. Setting up, in cooperation with the space agencies, European experimental facilities (in particular airborne sensors) needed to prepare for the use of data produced by the new types of sensor (in particular ERS 1 [Earth Resources Satellite] which will be operating from 1990). As Europe has no facilities of its own, it is dependent on the United States or Canada.

5. Contributing to the definition of future space missions that meet the requirements of the various categories of users and promoting the establishment of user associations.

6. Identifying together with the parties concerned (in particular space system operators and the European Association of Remote Sensing Laboratories) and in collaboration with the ESA, the necessary measures at European level to support the emergence of a commercial supply of value added services.

Market research (pubic and private) and studies on economic conditions for the development of markets (organization of supply, pricing policy, etc.) should provide essential information needed by the various parties concerned.

7. Promoting common positions by the Member States in international negotiations on problems relevant to the legal and economic environment for remote sensing (legal questions linked to the access to and use and protection of space data, pricing policy, etc.)

D. Industrial Development: Further Study of the Implications of the Single Market

Unlike the position for launchers, in telecommunications (space and ground segments) the space industry is fragmented and is therefore not able to exploit the economies of scale inherent in markets of that size.

The achievement of a genuine internal market in 1992, the opening-up of access to public contracts and the liberalization of national regulations should play a vital role in improving European competitiveness, since it could benefit from economies of scale of the same order of magnitude as those which have helped to make

American industry so successful. This change in the economic environment of the European space industry will create favourable conditions for structural adaptations leading to greater competitiveness.

In cooperation with the parties concerned, the Commission will continue to study the implications of the large single market for space and space-related activities so as to identify any specific measures to be taken to allow their optimum development.

E. Legal Environment: Contributing to the Establishment of Favourable Conditions for the Development of European Space Activities and Ensuring That These Activities Are in Harmony With Community Law

The Community effort should concentrate on the following action lines.

1. Commercial and competition policy

The Community must define its commercial policy for goods and services in the field of space, making sure that it obtains opinions from all the European parties involved. In the general interest it is desirable, in the arrangements to be made for the performance of their task, to prevent these parties from creating precedents liable to prejudice this section of commercial policy.

2. Taxation and customs arrangements

In view of its competences in this field, even though Community provisions of a general nature exist, the Commission might wish to lay down specific provisions for the privileges of space organizations.

3. Harmonization of legislation

The Commission intends to take steps to harmonize national laws relating to the activities conducted from space, thus establishing the legal security needed for the development of space activities. It also intends to encourage common positions by the Member State in international negotiations on space law.

F. Training: Promoting the Development of High-Level European Training

Community action in this field under the Comett program and in association with the academic and industrial worlds will help to develop high-level European training. It also appears useful to encourage consideration of the European dimension in training activities already in progress nationally, whether they concern initial or in-service training. [Passages omitted]

Evaluation of Current EC Activities

36980097 Brussels COMMISSION OF THE EUROPEAN COMMUNITIES COM (88) 417 in English 26 Jul 88 pp 12-24

[Excerpts] The fact that the Community is prompted to take a more active role in space is due to the new significance that space has gradually been assuming: the transistion from the heroic age of space conquest to that of the exploitation of space has given rise to a whole series of new challenges which have fundamental implications for the social and economic fabric. What are the difficulties Europe has to overcome in order to face these challenges? To illustrate the implications of these various developments, we shall distinguish between three main areas (telecommunications, Earth observation and microgravity) and three dimensions (industrial, legal and educational).

A. Telecommunications:

With their multiple applications ranging from telephony to teleinformatics and direct broadcasting, satellite telecommunications are currently the main commercial user of space technology. Since the development of the first European satellites in the 1970s, the major source of financing for the development of these systems has been the public sector. In Europe, responsibility for operating satellite telecommunications systems lies with the national PTTs and with Eutelsat; their technological development, on the other hand, requires development agencies such as the ESA and considerable financial resources. These investments have led to the setting up of a European satellite industry which, though technically on a par with its competitors, nevertheless recognizes the need to improve its competitive position.

1. Current applications

Satellite communication systems now represent an essential part of Europe's telecommunications network. They already provide a flexible and competitive response to problems of long-distance telephone links and television and radio broadcasting. Satellites are particularly competitive in cases where transmissions are used to link up with the least-developed regions with low population densities. Communications by satellite between mobile terminals represent another growth area, which has developed mainly to handle voice communication between large ships.

Although these systems are still basically publicly funded, private investment is beginning to be forthcoming for television broadcasting.

2. Future applications

Technological progress has meant that satellites are now powerful enough to allow firstly the installation of simpler and cheaper ground equipment and secondly, the growth of new services and new markets.

As a result, new fixed services such as dissemination of data, business communications for SMEs (especially in rural areas of the Community), videoconferencing and distance learning will become part of the daily routine. There are implications too for direct broadcasting by satellite which, if it becomes pan-European, is likely to open up national frontiers to a large market for ground equipment and lead to the growth of competitive services. As for mobile services, the extension of voice communication systems not only to ships of all sizes but also to planes and mobile land terminals will open up yet another promising potential market. Lastly, telecommunications in the rural areas of the developing countries represent yet another important area of application.

Despite these encouraging prospects for new services, serious obstacles nevertheless remain, preventing the new markets from developing and weakening the competitive position of European industry vis-a-vis the United States and Japan.

3. Obstacles

In order fully to appreciate the nature of these obstacles, it is essential to distinguish between the three main areas of satellite application: fixed services, direct broadcasting and mobile services.

3.1 Fixed services

In Europe telecommunications satellites are used chiefly for the broadcasting of television programs and only to a limited extent for intra-European telecommunications services (telephony and data transmission).

The regulations in force in the Member States do not allow unrestricted use of the space segment for data communications services and value-added services.

As announced in the Green Paper the Commission intends to discuss with the Member States how far European telecommunications satellites will play a part in providing a wider range of telecommunications services in the Community.

3.2 Direct broadcasting services (DBS)

A number of factors still stand in the way of the achievement of a large market for direct broadcasting by satellite.

The allocation of frequencies and orbits by the International Telecommunications Union (ITU) on a national basis in 1977 led to the growth of a number of non-interchangeable systems which, because of their limited geographical cover, are difficult to operate profitably.

At the same time the demand for satellite broadcasting channels continues to grow to the point where it now exceeds supply. Particular attention will have to be paid to resolving this problem, even though the arrival of new larger capacity satellites may help to absorb this excess demand.

Another effect of this foreseeable multiplication of television channels will be the need for more quality audiovisual production (cinema and television) which will ultimately determine the usage of the new equipment. Special attention has been paid to this question in the framework program on "Television without frontiers" proposed by the Commission and under the Media program of measures to encourage the development of the audiovisual industry.

As a final point of interest, high-definition television, which will considerably improve the quality of television pictures, will require in the coming years an effort by Europe to achieve a common standard; this common standard which has already been identified will enable Europe to guarantee compatibility with existing equipment, from production to reception by the general public, including transmission, and secondly to resist attempts to impose the Japanese standard.

3.3 Mobile services

The demand for mobile communications services in Europe is a pressing problem. If excessive fragmentation of this particular market is to be avoided mobile terminals in both the marine and aeronautics sector will have to be standardized as soon as possible.

Analyses will need to be made, particularly in the case of land-mobile systems, of the "niche" markets for telecommunications satellites applications (mainly long-distance lorries and private systems) in order to complete the pan-European system of mobile cellular radio which will be introduced in Europe beginning in 1992. At the same time a political decision will need to be taken as to which institutional organization will be made responsible for supplying the space segment of land-based mobile systems.

B. Earth Observation

Another major area of space exploitation, although one which is still in its infancy, is Earth observation. This area has potential applications of major economic and social, and even strategic importance. Earth observation satellites generate information which, by virtue of its synoptic and uniform and repetitive nature, opens up the prospect of more efficient management of the Earth's resources, better monitoring of the environment and, in the longer term, the global study of our planet (especially the "greenhouse effect" and the ozone layer) and the impact of human activity on it.

Satellite information covers a wide range of activities, weather forecasting, scientific research (Earth sciences), agricultural and forestry management, mineral, energy and water resource management, land use and urban development, forecasting of exceptional events (natural disasters) and accident management (oil spills, forest fires, etc.).

These applications therefore concern both the developed countries and developing countries, for whom problems of self-sufficiency of food supply and management of natural resources are crucial.

Much of this technology is now in Europe's grasp—with the Meteosat (weather observation) satellite, SPOT (the French optical satellite in operation since 1986) soon to be joined by ERS-1 (a satellite with microwave sensors developed by the ESA which will be put into orbit in 1990)—despite the fact that it embarked on the development of Earth observation techniques some ten years after the United States.

Programs for the development of more sophisticated observation systems are underway in the shape of SPOT 2 and 3 (France) and the European (ESA) programs for the development of polar platforms and of a new generation of weather satellites.

Moreover, with Earthnet, Eurimage and Spot-Image, Europe also has the structures for the distribution of satellite data.

Overall, however, the supply of data produced by existing Earth observation systems has not been matched by applications which are intensive or extensive enough for such systems to operate profitably.

While the use of remote sensing data has come of age for the purposes of, weather forecasting and, to a lesser extent, for cartography, prospecting for mineral resources and scientific research, on the whole little use has so far been made of its practical potential.

The development of applications markets is delayed or hampered by several factors, chiefly:

1. End users

With the exception of certain major institutional and private users, potential users—who fall into a wide variety of categories—are often unaware or poorly informed of possible applications and benefits of satellite data; as a result they are neither organized nor trained in the techniques for interpreting these data.

2. Data processing and interpretation

A major obstacle to the emergence of operational applications is the underdevelopment of methods, techniques and equipment. What European efforts are being made in this area are scattered. Too frequently techniques are developed for the initiated, with no concern for ruggedness, portability or cost-saving. There is therefore clearly a need for public support and better coordination of effort.

The sector for value-added services, which offers processed and interpreted data in response to the needs of various end users, could play a key role in the growth of applications markets. The fact is, however, that the firms in this still relatively undeveloped sector often have to compete with other bodies (public research establishments or universities) using their specific knowhow to exploit a particular segment of the market. This reduces the size of the potential market open to value-added services firms and their economic prospects. This in turn reduces their capacity for financing their own development of methods and techniques for processing and interpreting remote sensing data.

3. In-orbit observation and ground data reception systems

Guaranteed continuity in the availability of data—relating to the space segment and the corresponding ground segment—for a minimum requirements of ten years is an essential precondition for the development of applications.

The continuity of the French SPOT program is now assured and the continuity in the availability of data from the ERS satellite system of the ESA should be guaranteed as soon as possible;

Other factors that will influence the emergency of certain operational applications include advances in sensor performance (all-weather observation and greater geometrical and spectral resolution), acquisition times and data frequency.

Other factors will also have an influence on the use of Earth observation systems: the legal climate (regulations governing access to data, protection of intellectual property), product standardization, pricing policy and international cooperation particularly for the major programs investigating the global changes affecting our planet. The lack of sufficient data receiving stations is also a restricting factor in Third World countries.

Consequently, if Europe wishes to be able to hold its own in both international cooperation and international competition, it is high time that European efforts in this area were given a new dimension and coherence, capitalizing on its technical achievements by acting on those factors affecting the development of applications markets, while at the same time pushing ahead with the development of European space techniques.

C. Microgravity

The use of the microgravity environment found in space is the third major area for space applications after telecommunications and Earth observation. However, it

is far less advanced than the other two in the sense that it will require major investment in research for many years to come before it leads to any commercial applications.

Microgravity (which cannot be obtained on Earth for prolonged periods) is an emerging area of technology which has potentially important strategic implications in terms of expanding the frontiers of scientific knowledge and its industrial applications. The technology of high-performance materials for structural applications or for electronics and optics, pharmaceuticals, biotechnology and biochemistry manufacturing and better understanding of the life sciences are the areas in which microgravity appears to offer the best potential benefits.

Microgravity research can lead either to improvements in manufacturing processes on Earth or to the development of new products specific to space. Because of the extremely high cost of working in microgravity conditions, the latter products will necessarily have a high added value.

Europe's overall situation in this area is good relative to that of the United States and Japan, with the combined efforts of the ESA and the Member States matching those of the U.S.

The ESA funds orbital infrastructure development, the cost of missions and multi-user equipment; the ground preparation of experiments, including the development of specialized equipment, is dealt with at national level, particularly in France and the Federal Republic of Germany. Building on its experience of the Spacelab development, Germany is concentrating its efforts in relation to the exploitation of space applications in the field of microgravity, in which it plays a leading role in Europe.

Like the United States and Japan, Europe is putting a great deal of funding, within the ESA framework, into the establishment of an orbital infrastructure (Eureca and some European components of the International Space Station) which will considerably increase the opportunities for microgravity experiments in both quantitative and qualitative terms (duration, frequency of experiments and level of residual microgravity).

However, it is clear that additional efforts, complementary to existing national and ESA programs, will be needed in order to make optimum use of this experimental potential and in particular to enlarge and begin preparing the user community, which is heterogeneous and generally poorly informed.

It will take a decade at least to acquire the experience and establish the scientific foundations essential to the launching of industry-oriented projects.

A longer-term user strategy and a more coordinated European approach would enable Europe to cater more efficiently for the information, training and funding needs of users.

The Community encourages cooperation in a number of areas concerned by microgravity through its research programs and is therefore naturally well placed to help promote the use of microgravity in particular by integrating microgravity experiments into a ground research strategy.

D. Industrial Development

An analysis of the structure and organization of the European space industry must draw a distinction between the space segment, which is still characterized by a large public sector presence, and the ground segment which by its nature is closer to large-scale manufacturing industries.

1. Space segment

Acting as a catalyst and coordinator of European efforts, the ESA has endeavoured to enhance the autonomy and competitiveness of the European space industry.

This action has had important positive effects:

— first, the contracts concluded by the ESA result in a high level of intra-European cooperation in Europe's space industry organized around a small number of major aerospace companies;

— secondly, these cooperation agreements entail specialization by European firms consistent with the objectives defined by national industrial policies.

However, while the aim of the ESA programs, namely to develop a competitive European space industry on the world market, has been attained in technical terms, the commercial situation is a rather mixed one.

In the field of launch vehicles, the transition from technological development to commercialization and production has been successfully carried through. Europe now has 50 percent of the world launch services market, chiefly as a result of the stable industrial structure represented by Arianespace. Europe, which has profited from a series of failure and hitches in American transportation systems, will in the coming years have to face tougher competition with the return in force of American launch vehicles and the appearance of other competitors on the market (USSR, Japan and China). Two important factors will determine the competitiveness of European launch systems: first, the efforts already being made by the industry to reduce costs and, secondly, a lasting command of reliability, which is essential to the development of space applications.

In the field of one-off scientific satellites and meteorological or remote sensing satellites manufactured in small quantities, the European space industry is competitive in both technical performance and price. This situation can be put down to the lower-cost engineering environment and lower cost of scientific work in Europe compared with the United States. Unfortunately, the limited size of the international market makes it impossible to capitalize on this competitive advantage.

In the telecommunications field, which is currently the main market for commercial applications in the space segment, the transition from the R&D to the commercialization stage has not been accompanied by the rationalization necessary for the emergence of European leaders. The main reason is that the major firms are excessively dependent on their national administrations which, acting both as market regulators and customers, tend to favour their own national industry. They have a decisive influence on defining the specifications of space products, thereby hindering the standardization of subsystems and affecting production costs.

In relative terms, therefore, the space industry is handicapped on both the European and world markets since without a true European dimension it cannot take advantage of economies of scale.

The "juste retour" principle enshrined in the ESA Convention which guarantees the participating states industrial contracts commensurate with their level of contributions, combined with the size of public procurement contracts, has had the effect, in the large countries, of concentrating space activity within a few firms specialized in the aerospace sector and the large R&D programs.

This situation prompts industrialists to focus on the technological challenges at the expense of a genuine commercial strategy.

There would appear to be a case for less rigorous application of the ESA's "juste retour" arrangement, particularly since the concept of juste retour is alien to the basic principles of the Community. This would permit greater competition without prejudicing the interests of the Member States.

2. Ground segment

In the ground segment, a market with far greater potential for commercial development than the space segment, the weakness of European industry is even more in evidence.

The United States and Japan control 80 percent of the world market for the ground equipment which is essential to the operation of telecommunications satellites. The weakness of European industry in this area can be put down to three basic factors: the fragmentation of the European market, national regulations and the slow pace of harmonization of technical standards.

The obstacles to the competitiveness of the ground segment industry are described in the earlier section on telecommunications.

E. Legal Environment

The participation of the Member States of the Community in the legal structure of European space organizations, especially the ESA, raises a number of problems inasmuch as the Member States have conferred on the Community exclusive or joint competence according to the matters involved. Now that the Single Act has reaffirmed the Community's competence in the field of research and the environment, in addition to its original competence particularly in commercial matters and competition, there are areas in which there is a potential overlap between the actions of organizations in the space sector and those of the Community. This requires an organic form of coordination. Naturally there is nothing to prevent the Member States from settling between themselves or with non-member countries issues that fall outside the scope of the Treaty. However, if that is the case, the Community's competence must be preserved.

The most important areas where Community competence overlaps with space issues include:

— commercial policy
— competition
— taxation and customs arrangements
— harmonization of legislation.

1. Commercial policy

In the context of the multilateral trade negotiations, the Commission is negotiating on behalf of the Community a multilateral overall agreement on trade in services (Uruguay Round) covering all types of services liable to figure in international transactions, which includes space services.

Certain general provisions of the agreement on services will have a particular significance for the space sector and it will probably be necessary to adopt specific provisions for implementing them in this sector, for example as regards right of access to the space services market. As space services become more diversified with technological progress, it will be especially important to ensure that the provisions of the services agreement are adapted to that situation.

Whatever the case, the provisions of the agreement on services will have to be compatible with Europe's interests in the space sector.

The rapid development of competition in this sector will also make the question of subsidies into an increasingly sensitive issue and the concept of a reasonable level of subsidy will become more and more restrictive. It is important that the Community should retain its full competence in this regard, particularly on commercial defence matters.

2. Competition

The development of space technology and applications has led to the setting up of private companies such as Arianespace and Spot-Image, whose purpose is to commercialize space services and products. At the present stage of the development of space technology, this marketing activity is still underpinned by publicly funded R&D.

It would be in the interest of these companies to ensure that their activities have a secure basis in Community law, in view of the competition rules applicable within the Community.

3. Taxation and customs arrangements

While clarification of the relevant Community provisions may be desirable, there are no major problems in this area. The conventions establishing the ESA, Eutelsat and Eumetsat confer privileges and immunities on these organizations for the purpose of exercising their official activities, in particular with regard to tax and customs arrangements, to enable them to carry out the tasks conferred on them by their member states. Community law does give Member States the possibility of granting such exemptions.

4. Harmonisation of legislation - legal arrangements applicable to activities carried out from space

The development of activities carried out from space and, especially, in future space stations allowing man to live and work in space, will call for a rethinking and change of emphasis in the field of space law, which up to now has essentially been a branch of public international law drawn up under the auspices of the United Nations.

Space—a field not subject to national appropriation—will be used on an increasingly large scale for new economic activities requiring the framing of space law and legislation applicable to the products of space activities.

The main issues to be addressed include:

- Protection of satellite data used for commercial purposes (remote sensing data);
- Formulation and harmonization of laws on intellectual property (protection of inventions or counterfeiting in space), civil and penal law (astronauts), taxation and movement of goods between Earth and space;
- Protection of the circumterrestrial environment (space debris, etc.).

F. Training

The rapid advances in space technologies and their industrial and commercial applications are creating a demand for personnel highly-qualified in these new interdisciplinary fields, since these are emerging technologies requiring high-level qualifications. Appropriate training programs will help to strengthen the competitive position of the European space industry. [Passages omitted]

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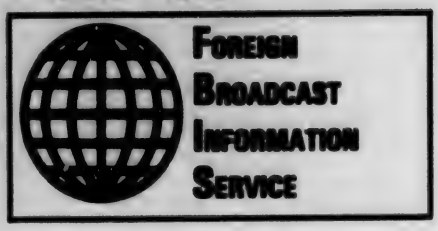

JPRS Report

Science & Technology

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EC Commission Proposal for Space Program

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JPRS-EST-89-006 *7 MARCH 1989*

CONTENTS

36980097 Brussels COMMISSION OF THE EUROPEAN COMMUNITIES COM (88) 417 in English 26 Jul 88

[Communication from the Commission: "The Community and Space: A Coherent Approach"]

EC Commission Proposes Space Program

Introduction

36980097 Brussels COMMISSION OF THE EUROPEAN COMMUNITIES COM (88) 417 in English 26 Jul 88 pp 1-3

[Communication from the Commission: "The Community and Space: A Coherent Approach"]

[Excerpts] 1. Space is an area in which the Community now seems destined to play a broader and more active role for a combination of reasons:

— The era of the conquest of space has given way to an era of space exploitation. Against a background of growing involvement leading to more opportunities for cooperation but also increased competition, a whole series of already well established applications (telecommunications, Earth observation) or emerging applications (microgravity) have given rise to new challenges. Today space is far more than just a specific sector of activity; it will affect more and more the whole economic, industrial and cultural life of European society.

— Relying on the expertise developed especially as a result of the cooperation within the framework of the European Space Agency (ESA), Europe has now reached the stage of commercial exploitation in a number of sectors such as launch vehicles or telecommunications. In fact, through the decisions taken at The Hague in December 1987, it has continued the existing momentum by embarking on an ambitious space program geared to the year 2000, structured around the Ariane V. Hermes and Columbus programs.

— With the adoption of the Single Act the Community has recently acquired wide-ranging and explicit competences in the field of research and technological development. Above all, it is already mobilizing for the completion of the large internal market by 1992, a process which has implications for many sectors concerned by space activities and which cannot be divorced from Europe's pursuit of its ambitions in space.

2. When it comes to realizing its ambitions Europe has a large number of strong points to its credit, as demonstrated by the string of successes with Ariane, Spacelab, Giotto, etc. However, alongside the strengths to which these successes testify, Europe's space effort also suffers from a number of weaknesses. While a great deal of effort has been put into the development of space systems, there is still a need for a matching effort to encourage exploitation of the potential offered by these techniques. Europe is still without a cogent overall policy which incorporates technological, industrial, commercial, social, and even defence aspects.

3. Taking into account these weaknesses on the one hand and the institutional nature of the Community on the other, it would appear that Community action in space is both possible and desirable and that such action would indeed make a significant contribution to Europe's space effort, provided that the Community endeavours

— to put the full weight of its democratic legitimacy and its established role in European society behind the ambitious new programs which the ESA has decided to undertake and to further enhance, by strengthening its links with the ESA, the political credibility of Europe's space effort on the international stage;

— to frame policies that create favourable conditions for the development of the technologies needed for access to space and for optimum exploitation of space applications, on the one hand, and for the integration of these applications in the socio-economic fabric of the Community and for the strengthening of the European space industry's presence in the world, on the other;

— to ensure, through organic consultation mechanisms, that action by the Member States, the ESA and other European organizations (Eutelsat, Eumetsat, and so on) in the space sector remains consistent with Community law on competition, trade policy, opening up of public procurement, intellectual property, etc.

4. The Commission is proposing for the purposes of future Community action in space, six action lines intended to provide a coherent framework for the development of its activities. These action lines are as follows:

(1) **Research and technological development (R&TD):** to promote greater complementarity and synergy between Community R&TD strategy and the programs of the space agencies. In particular, this will entail improving coordination between the relevant Community programs, (Esprit [European Strategic Programs for Research and Development in Information Technology], Brite [Basic Research in Industrial Technologies for Europe], Euram [European Research on Advanced Materials], RACE [Research and Development in Advanced Communications Technologies for Europe], a number of JRC [Joint Research Center] programs, etc.) and European space programs; to define and give effect to Europe's contribution to the international study program on "global change" on our planet; to stimulate under the existing programs projects involving microgravity experiments and to promote the development of applications (telecommunications and Earth observation).

(2) **Telecommunications:** to develop a coherent approach by ensuring that satellite technology is included in the development of European networks and services and by optimizing the complementary relationship of satellite and terrestrial systems; to create the

political, regulatory and standardization conditions conducive to the development of new services and equipment; to promote the use of satellite communication systems in the implementation of Community policies on regional development, development aid, education, transport etc.;

(3) **Earth observation:** to stimulate the applications market particularly by extending and intensifying the integration of satellite information in the implementation of Community policies (agriculture, environment, regional development, development aid, etc.); by promoting cooperation and coordination in R&TD with regard to techniques for processing and interpreting satellite data.

(4) **Industrial development:** to study in greater depth in conjunction with the relevant bodies concerned the implications of the single market with regard to space activities and space-related activities.

(5) **Legal environment:** to contribute to the creation of favourable conditions for the development of European space activities by studying and proposing appropriate measures in the field of commercial and competition policy, tax and customs arrangements and harmonization of legislation.

(6) **Training:** to encourage under the Comett program the development of European advanced training schemes related to space science and technology and their applications.

Six Development Areas Proposed

36980097 Brussels COMMISSION OF THE EUROPEAN COMMUNITIES COM (88) 417 in English 26 Jul 88 pp 27-35

[Excerpts] In the light of its analyses which will be pursued and consultations with the European Space Agency and other relevant organizations and parties, the Commission considers that Community action could contribute in a significant way to removing a number of obstacles to the optimal exploitation of Europe's space potential. It is therefore proposing six action lines for the consistent development of its space activities.

A. Research and Technological Development (R&TD): Promoting Greater Complementarity and Interaction Between the Community R&TD Strategy and the Programs of the Space Agencies

Three sectors should be distinguished:

1. Space: a technological frontier

Implementation of the new ESA programs (Ariane V. Hermes and Columbus in particular) will call for the acquisition of new knowledge and technological expertise in a number of generic fields also relevant to other industrial sectors: information and communications technologies, robotics, advanced materials, aerodynamics, aerothermodynamics, man-machine interface, reliability and safety of complex systems, quality control, energy sources, medical sciences and technologies, etc.

A comparative analysis of the technological requirements of the ESA programs and the objectives of the Community's research program shows many points of convergence. A large number of Community programs are concerned: Esprit, Brite, Euram, RACE, medical and health research, radiation protection, non-nuclear energy, several JRC programs and new programs in the aeronautical sector and on robotics in hostile environments (Teleman).

Regular exchanges of information and coordination with the ESA are therefore indispensable both at the planning level and in the implementation of research programs so as to avoid duplication and facilitate use by the space industry of the technologies developed under Community programs.

The space programs also generate new knowledge and technologies that could be used by non-space industries.

The space agencies' efforts to exploit technological opportunities could benefit from the experience and support from the Community activities to promote technology transfer and innovation.

2. Space technologies and facilities: tools at the service of research

2.1 Study of our planet: climate, environment and global change

Earth observation satellites are a major source of information for the development of climate models and the study of the impact of human activities on climate and environment.

The development of new remote sensing techniques and the gradual establishment of a world space observation network make it possible to plan for the systematic study of the planet and its global change (in particular greenhouse effect and depletion of the ozone layer) leading to the acquisition of knowledge vital to the more efficient management of our environment and of human activities.

Since this is a problem that has international implications and raises major issues for society, Europe must organize itself so as to play an active and consistent role in international programs relevant to these areas. It must rapidly define its objectives and priorities and set up the necessary mechanisms and resources enabling it to participate on a more even footing with the United States and the USSR.

Considering that Community action would be the most efficient way of stimulating and coordinating efforts at European level, the Commission intends to submit, for the next review of the framework program on research and technological development, a proposal for action which follows up the programs now under way or in preparation. It will also see to it, in cooperation with the ESA, that there is a proper balance between space missions and the requirements of the scientific community.

2.2 Microgravity: encouraging preparations for the use of the orbital infrastructure

Like the United States and Japan, Europe is spending large amounts, mainly within the ESA, on setting up an orbital infrastructure which will greatly increase the opportunities for microgravity experiments. The ESA activities are focused essentially on the financing of platforms, mission costs and multi-user equipment; a major additional effort is therefore needed to prepare for the use of this experimental potential.

Under existing research programs the Commission intends to encourage a few collaborative projects that will bring together various user groups on particularly promising subjects. At the same time it will continue its consultations with the ESA and other parties concerned in order to determine more precisely the priority objectives and procedures for a possible Community program, on a wider and more ambitious scale, that would complement the activities of the ESA and the Member States.

3. Research and development to promote applications of space systems

This point is dealt with under action lines B. Telecommunications and C. Earth observation.

B. Space and Terrestrial Telecommunications: Need for a Consistent Approach to the Network, to the Development of New Services and to Regulations

In line with the Community's overall telecommunications policy, which regards the strengthening of European telecommunications as one of the essential conditions for a competitive market in the Community, the Commission put forward in June 1987 its Green Paper on the future development and liberalization of telecommunications. One of the reasons for this document is the need to reach common positions on the modification of the regulatory environment for telecommunication satellites in Europe; its objective is in particular the complete and gradual opening of the terminal market to competition and the definition of common European positions within various international bodies.

The Commission intends to pursue these aims as regards telecommunications satellites by developing the following activities:

1. Ensuring that satellite techniques are taken into consideration in the development of networks and services at European level and optimizing the complementarity of satellite and terrestrial systems

Coordination will be necessary between the Commission, the telecommunications administrations, satellite operators and the ESA. Ongoing technological progress towards more powerful satellites and hence less costly ground terminal equipment is a trend that is likely to continue, at least for some time, and could lead to an in-orbit switching capability. To make full use of the advantages of this technological development, careful planning of the overall network will be necessary so as to ensure continuous complementarity and compatibility between terrestrial techniques and the new generations of satellites.

2. Creating the political, regulatory and standardization conditions necessary for the development of new services and equipment to ensure maximum exploitation of space systems

Here the Commission proposes to act at three levels: harmonization of standards for communication systems (satellite access) and ground equipment, promotion of the study of regulatory systems likely to provide favourable conditions for the development of value added services and political action to ensure the setting up of a European telecommunications network with optimum complementarity of the various telecommunications techniques (see details in Annex 1).

3. Promoting the use of satellite communication systems in the implementation of Community policies

The Commission will continue and step up its efforts to achieve the following objectives:

- *Rural and regional development:* improvement of the advanced telecommunications infrastructure in the less-favoured regions of the Community (STAR) and in the Mediterranean basin.
- *Aid to developing countries:* helping to finance studies, technical assistance and the space communications infrastructure.
- *Education and training:* promotion of the use of new technologies to improve levels of skills in the Community.
- *Transport:* improvement of land and sea communications, especially for small firms, and study of the potential of space techniques for surveillance and management systems for land, air and sea traffic.
- *Fishing:* analysis of the various satellite options for communications and the positioning of fishing boats.

4. R&D to promote the development of space system applications

Through its R&D activities the Commission will help to promote the development of applications of satellite systems, whether under the RACE program (development of technologies for a pan-European integrated broadband telecommunications network), the new Delta program (distance learning applications) or specific projects concerning the adaptation of ground equipment to the Third World market.

C. Earth Observation: Stimulation of the Applications Market

The use of space data will become an important, if not indispensable, aid in the implementation of several Community policies: agriculture, environment, fisheries, regional development and development aid. The use of these data in scientific research (studies of our planet in particular) is covered in section A.2.

The Commission intends to extend and intensify the integration of satellite information in the implementation of Community policies.

Because of the extent, continuity and variety of the Community's demand, both as a final user and as an intermediary for final users such as regional or local authorities and developing countries, the Community is bound to have a decisive effect on the establishment of a stable applications market.

Consequently the Commission proposes a coordinated set of actions designed not only to develop operational applications meeting its own requirements but also to stimulate the development of applications markets in general.

1. Promoting European cooperation and coordination in R&D on methods and techniques for processing and interpreting satellite data

The Community is already active in this field with the JRC's remote sensing program which is already helping to improve the consistency of national efforts. However, they are still too scattered. The gradual broadening and expansion of Community activities is necessary not only for the requirements of its own policies but also, through a network of laboratories associated with the JRC's work and by shared-cost projects, to stimulate European cooperation amongst all those concerned, whether laboratories or industry. In the context of that cooperation the Commission will also endeavour to promote product standardization.

2. Stepping up the demonstration of operational applications (pilot projects), promoting feasibility studies and implementing operations systems in Europe

This mainly, although not exclusively, concerns applications relevant to the Community's sectoral policies mentioned earlier. An initial analysis of the applications of space data in Community policies is given in Annex 2.

3. Familiarization, training and assistance for users

A Community action plan for training in remote sensing techniques based on existing programs (the JRC's Ispra courses, Erasmus, Comett and Science) appears useful and should be carried out in cooperation with national activities. The JRC will also endeavour to exploit better its experience by being more active in the areas of receiving research scientists and giving assistance in the implementation of projects. This would apply in particular to European countries not having the necessary infrastructure and to the developing countries. For the latter, coordinated projects involving financial and technical support for local training should also be developed.

4. Setting up, in cooperation with the space agencies, European experimental facilities (in particular airborne sensors) needed to prepare for the use of data produced by the new types of sensor (in particular ERS 1 [Earth Resources Satellite] which will be operating from 1990). As Europe has no facilities of its own, it is dependent on the United States or Canada.

5. Contributing to the definition of future space missions that meet the requirements of the various categories of users and promoting the establishment of user associations.

6. Identifying together with the parties concerned (in particular space system operators and the European Association of Remote Sensing Laboratories) and in collaboration with the ESA, the necessary measures at European level to support the emergence of a commercial supply of value added services.

Market research (pubic and private) and studies on economic conditions for the development of markets (organization of supply, pricing policy, etc.) should provide essential information needed by the various parties concerned.

7. Promoting common positions by the Member States in international negotiations on problems relevant to the legal and economic environment for remote sensing (legal questions linked to the access to and use and protection of space data, pricing policy, etc.)

D. Industrial Development: Further Study of the Implications of the Single Market

Unlike the position for launchers, in telecommunications (space and ground segments) the space industry is fragmented and is therefore not able to exploit the economies of scale inherent in markets of that size.

The achievement of a genuine internal market in 1992, the opening-up of access to public contracts and the liberalization of national regulations should play a vital role in improving European competitiveness, since it could benefit from economies of scale of the same order of magnitude as those which have helped to make

American industry so successful. This change in the economic environment of the European space industry will create favourable conditions for structural adaptations leading to greater competitiveness.

In cooperation with the parties concerned, the Commission will continue to study the implications of the large single market for space and space-related activities so as to identify any specific measures to be taken to allow their optimum development.

E. Legal Environment: Contributing to the Establishment of Favourable Conditions for the Development of European Space Activities and Ensuring That These Activities Are in Harmony With Community Law

The Community effort should concentrate on the following action lines.

1. Commercial and competition policy

The Community must define its commercial policy for goods and services in the field of space, making sure that it obtains opinions from all the European parties involved. In the general interest it is desirable, in the arrangements to be made for the performance of their task, to prevent these parties from creating precedents liable to prejudice this section of commercial policy.

2. Taxation and customs arrangements

In view of its competences in this field, even though Community provisions of a general nature exist, the Commission might wish to lay down specific provisions for the privileges of space organizations.

3. Harmonization of legislation

The Commission intends to take steps to harmonize national laws relating to the activities conducted from space, thus establishing the legal security needed for the development of space activities. It also intends to encourage common positions by the Member State in international negotiations on space law.

F. Training: Promoting the Development of High-Level European Training

Community action in this field under the Comett program and in association with the academic and industrial worlds will help to develop high-level European training. It also appears useful to encourage consideration of the European dimension in training activities already in progress nationally, whether they concern initial or in-service training. [Passages omitted]

Evaluation of Current EC Activities

36980097 Brussels COMMISSION OF THE EUROPEAN COMMUNITIES COM (88) 417 in English 26 Jul 88 pp 12-24

[Excerpts] The fact that the Community is prompted to take a more active role in space is due to the new significance that space has gradually been assuming: the transistion from the heroic age of space conquest to that of the exploitation of space has given rise to a whole series of new challenges which have fundamental implications for the social and economic fabric. What are the difficulties Europe has to overcome in order to face these challenges? To illustrate the implications of these various developments, we shall distinguish between three main areas (telecommunications, Earth observation and microgravity) and three dimensions (industrial, legal and educational).

A. Telecommunications:

With their multiple applications ranging from telephony to teleinformatics and direct broadcasting, satellite telecommunications are currently the main commercial user of space technology. Since the development of the first European satellites in the 1970s, the major source of financing for the development of these systems has been the public sector. In Europe, responsibility for operating satellite telecommunications systems lies with the national PTTs and with Eutelsat; their technological development, on the other hand, requires development agencies such as the ESA and considerable financial resources. These investments have led to the setting up of a European satellite industry which, though technically on a par with its competitors, nevertheless recognizes the need to improve its competitive position.

1. Current applications

Satellite communication systems now represent an essential part of Europe's telecommunications network. They already provide a flexible and competitive response to problems of long-distance telephone links and television and radio broadcasting. Satellites are particularly competitive in cases where transmissions are used to link up with the least-developed regions with low population densities. Communications by satellite between mobile terminals represent another growth area, which has developed mainly to handle voice communication between large ships.

Although these systems are still basically publicly funded, private investment is beginning to be forthcoming for television broadcasting.

2. Future applications

Technological progress has meant that satellites are now powerful enough to allow firstly the installation of simpler and cheaper ground equipment and secondly, the growth of new services and new markets.

As a result, new fixed services such as dissemination of data, business communications for SMEs (especially in rural areas of the Community), videoconferencing and distance learning will become part of the daily routine. There are implications too for direct broadcasting by satellite which, if it becomes pan-European, is likely to open up national frontiers to a large market for ground equipment and lead to the growth of competitive services. As for mobile services, the extension of voice communication systems not only to ships of all sizes but also to planes and mobile land terminals will open up yet another promising potential market. Lastly, telecommunications in the rural areas of the developing countries represent yet another important area of application.

Despite these encouraging prospects for new services, serious obstacles nevertheless remain, preventing the new markets from developing and weakening the competitive position of European industry vis-a-vis the United States and Japan.

3. Obstacles

In order fully to appreciate the nature of these obstacles, it is essential to distinguish between the three main areas of satellite application: fixed services, direct broadcasting and mobile services.

3.1 Fixed services

In Europe telecommunications satellites are used chiefly for the broadcasting of television programs and only to a limited extent for intra-European telecommunications services (telephony and data transmission).

The regulations in force in the Member States do not allow unrestricted use of the space segment for data communications services and value-added services.

As announced in the Green Paper the Commission intends to discuss with the Member States how far European telecommunications satellites will play a part in providing a wider range of telecommunications services in the Community.

3.2 Direct broadcasting services (DBS)

A number of factors still stand in the way of the achievement of a large market for direct broadcasting by satellite.

The allocation of frequencies and orbits by the International Telecommunications Union (ITU) on a national basis in 1977 led to the growth of a number of non-interchangeable systems which, because of their limited geographical cover, are difficult to operate profitably.

At the same time the demand for satellite broadcasting channels continues to grow to the point where it now exceeds supply. Particular attention will have to be paid to resolving this problem, even though the arrival of new larger capacity satellites may help to absorb this excess demand.

Another effect of this foreseeable multiplication of television channels will be the need for more quality audiovisual production (cinema and television) which will ultimately determine the usage of the new equipment. Special attention has been paid to this question in the framework program on "Television without frontiers" proposed by the Commission and under the Media program of measures to encourage the development of the audiovisual industry.

As a final point of interest, high-definition television, which will considerably improve the quality of television pictures, will require in the coming years an effort by Europe to achieve a common standard; this common standard which has already been identified will enable Europe to guarantee compatibility with existing equipment, from production to reception by the general public, including transmission, and secondly to resist attempts to impose the Japanese standard.

3.3 Mobile services

The demand for mobile communications services in Europe is a pressing problem. If excessive fragmentation of this particular market is to be avoided mobile terminals in both the marine and aeronautics sector will have to be standardized as soon as possible.

Analyses will need to be made, particularly in the case of land-mobile systems, of the "niche" markets for telecommunications satellites applications (mainly long-distance lorries and private systems) in order to complete the pan-European system of mobile cellular radio which will be introduced in Europe beginning in 1992. At the same time a political decision will need to be taken as to which institutional organization will be made responsible for supplying the space segment of land-based mobile systems.

B. Earth Observation

Another major area of space exploitation, although one which is still in its infancy, is Earth observation. This area has potential applications of major economic and social, and even strategic importance. Earth observation satellites generate information which, by virtue of its synoptic and uniform and repetitive nature, opens up the prospect of more efficient management of the Earth's resources, better monitoring of the environment and, in the longer term, the global study of our planet (especially the "greenhouse effect" and the ozone layer) and the impact of human activity on it.

Satellite information covers a wide range of activities, weather forecasting, scientific research (Earth sciences), agricultural and forestry management, mineral, energy and water resource management, land use and urban development, forecasting of exceptional events (natural disasters) and accident management (oil spills, forest fires, etc.).

These applications therefore concern both the developed countries and developing countries, for whom problems of self-sufficiency of food supply and management of natural resources are crucial.

Much of this technology is now in Europe's grasp—with the Meteosat (weather observation) satellite, SPOT (the French optical satellite in operation since 1986) soon to be joined by ERS-1 (a satellite with microwave sensors developed by the ESA which will be put into orbit in 1990)—despite the fact that it embarked on the development of Earth observation techniques some ten years after the United States.

Programs for the development of more sophisticated observation systems are underway in the shape of SPOT 2 and 3 (France) and the European (ESA) programs for the development of polar platforms and of a new generation of weather satellites.

Moreover, with Earthnet, Eurimage and Spot-Image, Europe also has the structures for the distribution of satellite data.

Overall, however, the supply of data produced by existing Earth observation systems has not been matched by applications which are intensive or extensive enough for such systems to operate profitably.

While the use of remote sensing data has come of age for the purposes of, weather forecasting and, to a lesser extent, for cartography, prospecting for mineral resources and scientific research, on the whole little use has so far been made of its practical potential.

The development of applications markets is delayed or hampered by several factors, chiefly:

1. End users

With the exception of certain major institutional and private users, potential users—who fall into a wide variety of categories—are often unaware or poorly informed of possible applications and benefits of satellite data; as a result they are neither organized nor trained in the techniques for interpreting these data.

2. Data processing and interpretation

A major obstacle to the emergence of operational applications is the underdevelopment of methods, techniques and equipment. What European efforts are being made in this area are scattered. Too frequently techniques are developed for the initiated, with no concern for ruggedness, portability or cost-saving. There is therefore clearly a need for public support and better coordination of effort.

The sector for value-added services, which offers processed and interpreted data in response to the needs of various end users, could play a key role in the growth of applications markets. The fact is, however, that the firms in this still relatively undeveloped sector often have to compete with other bodies (public research establishments or universities) using their specific knowhow to exploit a particular segment of the market. This reduces the size of the potential market open to value-added services firms and their economic prospects. This in turn reduces their capacity for financing their own development of methods and techniques for processing and interpreting remote sensing data.

3. In-orbit observation and ground data reception systems

Guaranteed continuity in the availability of data—relating to the space segment and the corresponding ground segment—for a minimum requirements of ten years is an essential precondition for the development of applications.

The continuity of the French SPOT program is now assured and the continuity in the availability of data from the ERS satellite system of the ESA should be guaranteed as soon as possible;

Other factors that will influence the emergency of certain operational applications include advances in sensor performance (all-weather observation and greater geometrical and spectral resolution), acquisition times and data frequency.

Other factors will also have an influence on the use of Earth observation systems: the legal climate (regulations governing access to data, protection of intellectual property), product standardization, pricing policy and international cooperation particularly for the major programs investigating the global changes affecting our planet. The lack of sufficient data receiving stations is also a restricting factor in Third World countries.

Consequently, if Europe wishes to be able to hold its own in both international cooperation and international competition, it is high time that European efforts in this area were given a new dimension and coherence, capitalizing on its technical achievements by acting on those factors affecting the development of applications markets, while at the same time pushing ahead with the development of European space techniques.

C. Microgravity

The use of the microgravity environment found in space is the third major area for space applications after telecommunications and Earth observation. However, it

is far less advanced than the other two in the sense that it will require major investment in research for many years to come before it leads to any commercial applications.

Microgravity (which cannot be obtained on Earth for prolonged periods) is an emerging area of technology which has potentially important strategic implications in terms of expanding the frontiers of scientific knowledge and its industrial applications. The technology of high-performance materials for structural applications or for electronics and optics, pharmaceuticals, biotechnology and biochemistry manufacturing and better understanding of the life sciences are the areas in which microgravity appears to offer the best potential benefits.

Microgravity research can lead either to improvements in manufacturing processes on Earth or to the development of new products specific to space. Because of the extremely high cost of working in microgravity conditions, the latter products will necessarily have a high added value.

Europe's overall situation in this area is good relative to that of the United States and Japan, with the combined efforts of the ESA and the Member States matching those of the U.S.

The ESA funds orbital infrastructure development, the cost of missions and multi-user equipment; the ground preparation of experiments, including the development of specialized equipment, is dealt with at national level, particularly in France and the Federal Republic of Germany. Building on its experience of the Spacelab development, Germany is concentrating its efforts in relation to the exploitation of space applications in the field of microgravity, in which it plays a leading role in Europe.

Like the United States and Japan, Europe is putting a great deal of funding, within the ESA framework, into the establishment of an orbital infrastructure (Eureca and some European components of the International Space Station) which will considerably increase the opportunities for microgravity experiments in both quantitative and qualitative terms (duration, frequency of experiments and level of residual microgravity).

However, it is clear that additional efforts, complementary to existing national and ESA programs, will be needed in order to make optimum use of this experimental potential and in particular to enlarge and begin preparing the user community, which is heterogeneous and generally poorly informed.

It will take a decade at least to acquire the experience and establish the scientific foundations essential to the launching of industry-oriented projects.

A longer-term user strategy and a more coordinated European approach would enable Europe to cater more efficiently for the information, training and funding needs of users.

The Community encourages cooperation in a number of areas concerned by microgravity through its research programs and is therefore naturally well placed to help promote the use of microgravity in particular by integrating microgravity experiments into a ground research strategy.

D. Industrial Development

An analysis of the structure and organization of the European space industry must draw a distinction between the space segment, which is still characterized by a large public sector presence, and the ground segment which by its nature is closer to large-scale manufacturing industries.

1. Space segment

Acting as a catalyst and coordinator of European efforts, the ESA has endeavoured to enhance the autonomy and competitiveness of the European space industry.

This action has had important positive effects:

— first, the contracts concluded by the ESA result in a high level of intra-European cooperation in Europe's space industry organized around a small number of major aerospace companies;

— secondly, these cooperation agreements entail specialization by European firms consistent with the objectives defined by national industrial policies.

However, while the aim of the ESA programs, namely to develop a competitive European space industry on the world market, has been attained in technical terms, the commercial situation is a rather mixed one.

In the field of launch vehicles, the transition from technological development to commercialization and production has been successfully carried through. Europe now has 50 percent of the world launch services market, chiefly as a result of the stable industrial structure represented by Arianespace. Europe, which has profited from a series of failure and hitches in American transportation systems, will in the coming years have to face tougher competition with the return in force of American launch vehicles and the appearance of other competitors on the market (USSR, Japan and China). Two important factors will determine the competitiveness of European launch systems: first, the efforts already being made by the industry to reduce costs and, secondly, a lasting command of reliability, which is essential to the development of space applications.

In the field of one-off scientific satellites and meteorological or remote sensing satellites manufactured in small quantities, the European space industry is competitive in both technical performance and price. This situation can be put down to the lower-cost engineering environment and lower cost of scientific work in Europe compared with the United States. Unfortunately, the limited size of the international market makes it impossible to capitalize on this competitive advantage.

In the telecommunications field, which is currently the main market for commercial applications in the space segment, the transition from the R&D to the commercialization stage has not been accompanied by the rationalization necessary for the emergence of European leaders. The main reason is that the major firms are excessively dependent on their national administrations which, acting both as market regulators and customers, tend to favour their own national industry. They have a decisive influence on defining the specifications of space products, thereby hindering the standardization of subsystems and affecting production costs.

In relative terms, therefore, the space industry is handicapped on both the European and world markets since without a true European dimension it cannot take advantage of economies of scale.

The "juste retour" principle enshrined in the ESA Convention which guarantees the participating states industrial contracts commensurate with their level of contributions, combined with the size of public procurement contracts, has had the effect, in the large countries, of concentrating space activity within a few firms specialized in the aerospace sector and the large R&D programs.

This situation prompts industrialists to focus on the technological challenges at the expense of a genuine commercial strategy.

There would appear to be a case for less rigorous application of the ESA's "juste retour" arrangement, particularly since the concept of juste retour is alien to the basic principles of the Community. This would permit greater competition without prejudicing the interests of the Member States.

2. Ground segment

In the ground segment, a market with far greater potential for commercial development than the space segment, the weakness of European industry is even more in evidence.

The United States and Japan control 80 percent of the world market for the ground equipment which is essential to the operation of telecommunications satellites. The weakness of European industry in this area can be put down to three basic factors: the fragmentation of the European market, national regulations and the slow pace of harmonization of technical standards.

The obstacles to the competitiveness of the ground segment industry are described in the earlier section on telecommunications.

E. Legal Environment

The participation of the Member States of the Community in the legal structure of European space organizations, especially the ESA, raises a number of problems inasmuch as the Member States have conferred on the Community exclusive or joint competence according to the matters involved. Now that the Single Act has reaffirmed the Community's competence in the field of research and the environment, in addition to its original competence particularly in commercial matters and competition, there are areas in which there is a potential overlap between the actions of organizations in the space sector and those of the Community. This requires an organic form of coordination. Naturally there is nothing to prevent the Member States from settling between themselves or with non-member countries issues that fall outside the scope of the Treaty. However, if that is the case, the Community's competence must be preserved.

The most important areas where Community competence overlaps with space issues include:

— commercial policy
— competition
— taxation and customs arrangements
— harmonization of legislation.

1. Commercial policy

In the context of the multilateral trade negotiations, the Commission is negotiating on behalf of the Community a multilateral overall agreement on trade in services (Uruguay Round) covering all types of services liable to figure in international transactions, which includes space services.

Certain general provisions of the agreement on services will have a particular significance for the space sector and it will probably be necessary to adopt specific provisions for implementing them in this sector, for example as regards right of access to the space services market. As space services become more diversified with technological progress, it will be especially important to ensure that the provisions of the services agreement are adapted to that situation.

Whatever the case, the provisions of the agreement on services will have to be compatible with Europe's interests in the space sector.

The rapid development of competition in this sector will also make the question of subsidies into an increasingly sensitive issue and the concept of a reasonable level of subsidy will become more and more restrictive. It is important that the Community should retain its full competence in this regard, particularly on commercial defence matters.

2. Competition

The development of space technology and applications has led to the setting up of private companies such as Arianespace and Spot-Image, whose purpose is to commercialize space services and products. At the present stage of the development of space technology, this marketing activity is still underpinned by publicly funded R&D.

It would be in the interest of these companies to ensure that their activities have a secure basis in Community law, in view of the competition rules applicable within the Community.

3. Taxation and customs arrangements

While clarification of the relevant Community provisions may be desirable, there are no major problems in this area. The conventions establishing the ESA, Eutelsat and Eumetsat confer privileges and immunities on these organizations for the purpose of exercising their official activities, in particular with regard to tax and customs arrangements, to enable them to carry out the tasks conferred on them by their member states. Community law does give Member States the possibility of granting such exemptions.

4. Harmonisation of legislation - legal arrangements applicable to activities carried out from space

The development of activities carried out from space and, especially, in future space stations allowing man to live and work in space, will call for a rethinking and change of emphasis in the field of space law, which up to now has essentially been a branch of public international law drawn up under the auspices of the United Nations.

Space—a field not subject to national appropriation—will be used on an increasingly large scale for new economic activities requiring the framing of space law and legislation applicable to the products of space activities.

The main issues to be addressed include:

- Protection of satellite data used for commercial purposes (remote sensing data);
- Formulation and harmonization of laws on intellectual property (protection of inventions or counterfeiting in space), civil and penal law (astronauts), taxation and movement of goods between Earth and space;
- Protection of the circumterrestrial environment (space debris, etc.).

F. Training

The rapid advances in space technologies and their industrial and commercial applications are creating a demand for personnel highly-qualified in these new interdisciplinary fields, since these are emerging technologies requiring high-level qualifications. Appropriate training programs will help to strengthen the competitive position of the European space industry. [Passages omitted]

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